

**IN THE CLAIMS:**

- 1 1. (Previously Presented) A method for a particular file server to allocate a spare disk to  
2 replace a failed disk in a network storage system comprising the steps of:  
3       identifying a set of spare disks, the set of spare disks attached to a plurality of file  
4 servers of the network storage system;  
5       choosing a best spare disk of the set of spare disks, the best spare disk attached to  
6 any of the file servers of the plurality of file servers, the best spare disk chosen according  
7 to a plurality of user-selectable policies; and  
8       claiming ownership of the best spare disk.
- 1 2. (Original) The method of claim 1 further comprising the steps of:  
2       choosing, in response to a failure of the step of claiming ownership, a next best  
3 spare disk of the spare disks available; and  
4       claiming ownership of the next best spare disk.
- 1 3. (Original) The method of claim 2, wherein the step of claiming ownership of the best  
2 spare disk further comprises the steps of:  
3       setting a first ownership attribute to a file server-owned state; and  
4       setting a second ownership attribute to a file server-owned state.
- 1 4. (Previously Presented) The method of claim 1 wherein the step of choosing the best  
2 spare disk further comprises the steps of:  
3       selecting one or more disks from the set of spare disks that satisfy one or more  
4 hard-coded rules;  
5       sorting the one or more disks selected from the set of spare disks according to the  
6 plurality of user-selectable policies to identify a highest-ranked disk;  
7       choosing a highest-ranked disk as the best spare disk; and

8 choosing, in response to more than one of the one or more disks being highest-  
9 ranked, one disk at random, from the more than one of the one or more disks that are  
10 highest-ranked, as the best spare disk.

1 5. (Previously Presented) A method of verifying that a plurality of disks in a volume are  
2 optimally configured comprising the steps of:

3 identifying all of the disks in the volume;  
4 obtaining disk characteristics, respectfully, from all of the disks in the volume;  
5 comparing the disk characteristics with a set of policies and characteristics of  
6 spare disks; and  
7 alerting an administrator if a more optimal configuration of which disks are used  
8 in the volume and which disks are spare is possible.

1 6. (Previously Presented) The method of claim 5 further comprising the step of:  
2 reconfiguring the disks into the more optimal configuration.

1 7. (Previously Presented) A method of selecting a best spare disk for use by a filer in a  
2 network storage system including a plurality of filers, and serving an array of disks from  
3 a set of spare disks comprising the steps of:

4 selecting one or more disks from the set of spare disks attached to any of the filers  
5 of the plurality of filers, said set of disks satisfying one or more hard-coded rules;  
6 sorting the one or more disks using a set of user-selectable policies;  
7 if only one disk is highest-ranked, selecting the one disk that is highest-ranked as  
8 the best spare disk; and  
9 if a plurality of disks are highest-ranked, selecting one of the disks from the plu-  
10 rality of disks that are highest-ranked as the best spare disk.

1 8. (Cancelled)

1 9. (Previously Presented) A network storage system including a plurality of spare disks,  
2 comprising:

3 means for identifying the plurality of spare disks, the set of spare disks attached to  
4 a plurality of file servers of the network storage system;

5 means for selecting a best spare disk from the plurality of spare disks, the best  
6 spare disk chosen according to a plurality of user-selectable policies; and

7 means for claiming ownership of the best spare disk.

1 10. (Previously Presented) The network storage system of claim 9, wherein the means  
2 for selecting a best spare disk from the plurality of spare disks further comprises:

3 means for selecting a set of disks from the plurality of spare disks that satisfy one or  
4 more hard-coded rules;

5 means for sorting the set of disks according to the plurality of user-selectable policies;  
6 and

7 means for selecting a highest-ranked disk from the set of disks.

1 11. (Previously Presented) A computer-readable medium, including program instruc-  
2 tions executing on a particular filer, for allocating a replacement disk to the particular  
3 filer, the program instructions performing the steps of:

4 identifying a set of spare disks the set of spare disks attached to a plurality of fil-  
5 ers of the network storage system;

6 choosing a best spare disk of the set of spare disks the best spare disk attached to  
7 any of the plurality of filers, the best spare disk chosen according to a plurality of user-  
8 selectable policies; and

9 claiming ownership of the best spare disk.

1 12. (Previously Presented) The computer-readable medium of claim 11, wherein the  
2 step of choosing the best spare disk further comprises the steps of:

3           selecting one or more disks from a set of spare disks that satisfy one or more hard-  
4   coded rules;  
5           sorting the one or more disks selected from the set of spare disks according to the  
6   plurality of user-selectable policies to identify a highest-ranked disk;  
7           choosing a highest-ranked disk as the best spare disk; and  
8           choosing, in response to more than one of the one or more disks being highest-  
9   ranked, one disk at random, from the more than one of the one or more disks that are  
10   highest-ranked, as the best spare disk.

1   13. (Previously Presented) A method for allocating a spare disk to replace a failed disk  
2   in a network storage system, comprising:

3           maintaining a plurality of volumes in the network storage system, each volume  
4   associated with a set of disk storage units;  
5           maintaining a plurality of spare disks in the network storage system;  
6           choosing a best spare disk of the plurality of spare disks to replace a failed disk,  
7   the failed disk associated with any volume of the network storage system; and  
8           replacing the failed disk with the best spare disk.

1   14. (Previously Presented) The method as in claim 13, further comprising:  
2           establishing at least one file server in the network storage system; and  
3           performing the step of choosing a best spare disk by the at least one file server.

1   15. (Previously Presented) The method as in claim 13, further comprising:  
2           establishing at least one file server in the network storage system; and  
3           performing the step of replacing the failed disk with the best spare disk by the file  
4   server.

1   16. (Previously Presented) The method as in claim 13, further comprising:

2           determining the best spare disk by selecting those disks from the plurality of spare  
3 disks which meet at least one selected rule.

1   17. (Previously Presented) The method as in claim 13, further comprising:

2           sorting disks in accordance with policies, and assigning a score to each disk as a  
3 result of the sorting; and

4           selecting the disk with a highest score as the best spare disk.

1   18. (Previously Presented) The method as in claim 13, further comprising:

2           determining those disks of the plurality of spare disks which meet at least one se-  
3 lected rule to form a selected pool of disks;

4           sorting disks of the selected pool of disks in accordance with policies, and assign-  
5 ing a score to each disk as a result of the sorting; and

6           selecting the disk with a highest score as the best spare disk.

1   19. (Previously Presented) The method as in claim 13, further comprising:

2           using a random selection process to select the best spare disk in the event that two  
3 or more disks appear to be equally the best spare disk.

1   20. (Previously Presented) A method for allocating a spare disk to replace a failed disk in  
2 a network storage system, comprising:

3           maintaining a plurality of volumes in the network storage system, each volume  
4 associated with a set of disk storage units;

5           maintaining a plurality of spare disks in the network storage system;

6           attempting to determine the best spare disk by selecting those disks from the plu-  
7 rality of spare disks which meet at least one rule;

8           replacing the failed disk with the best spare disk;

9           in the event that no spare disk meets the at least one rule, selecting a spare disk  
10 which violates the at least one rule as a selected disk; and

11 notifying an administrator that the selected spare disk violates the rule.

1 21. (Previously Presented) A network storage system, comprising:  
2 means for maintaining a plurality of volumes in the network storage system, each  
3 volume associated with a set of disk storage units;  
4 means for maintaining a plurality of spare disks in the network storage system;  
5 means for choosing a best spare disk of the plurality of spare disks to replace a  
6 failed disk, the failed disk associated with any volume of the network storage system; and  
7 means for replacing the failed disk with the best spare disk.

1 22. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for establishing at least one file server in the network storage system; and  
3 means for performing the step of choosing a best spare disk by the at least one file  
4 server.

1 23. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for establishing at least one file server in the network storage system; and  
3 means for performing the step of replacing the failed disk with the best spare disk  
4 by the file server.

1 24. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for determining the best spare disk by selecting those disks from the plural-  
3 ity of spare disks which meet at least one selected rule.

1 25. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for sorting disks in accordance with policies, and assigning a score to each  
3 disk as a result of the sorting; and  
4 means for selecting the disk with a highest score as the best spare disk.

1 26. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for determining those disks of the plurality of spare disks which meet at  
3 least one selected rule to form a selected pool of disks;  
4 means for sorting disks of the selected pool of disks in accordance with policies,  
5 and assigning a score to each disk as a result of the sorting; and  
6 means for selecting the disk with a highest score as the best spare disk.

1 27. (Previously Presented) The network storage system of claim 21, further comprising:  
2 means for using a random selection process to select the best spare disk in the  
3 event that two or more disks appear to be equally the best spare disk.

1 28. (Previously Presented) A network storage system, comprising:  
2 means for maintaining a plurality of volumes in the network storage system, each  
3 volume associated with a set of disk storage units;  
4 means for maintaining a plurality of spare disks in the network storage system;  
5 means for attempting to determine a best spare disk by selecting those disks from  
6 the plurality of spare disks which meet at least one rule;  
7 means for replacing the failed disk with the best spare disk;  
1 in the event that no spare disk meets the at least one rule, means for selecting a  
2 spare disk which violates the at least one rule as a selected disk; and  
3 means for notifying an administrator that the selected spare disk violates the rule.

1 29. (Previously Presented) A file server in a network storage system, comprising:  
2 a storage adapter to connect to a plurality of disk storage units in the network  
3 storage system;  
4 an operating system to maintain a plurality of volumes, each volume associated  
5 with a set of disk storage units, the set of disk storage units selected from the plurality of  
6 disk storage units;

7           the operating system maintaining a plurality of spare disks units selected from the  
8 plurality of disk storage units;

9           the operating system choosing a best spare disk of the plurality of spare disks to  
10 replace a failed disk, the failed disk associated with any volume of the network storage  
11 system; and

12           the operating system replacing the failed disk with the best spare disk.

1   30. (Previously Presented) The file server of claim 29, further comprising:

2           the operating system determining the best spare disk by selecting those disks from  
3 the plurality of spare disks which meet at least one selected rule.

1   31. (Previously Presented) The file server system of claim 29, further comprising:

2           the operating system sorting disks in accordance with policies, and assigning a  
3 score to each disk as a result of the sorting; and

4           the operating system selecting the disk with a highest score as the best spare disk.

1   32. (Previously Presented) The file server system of claim 29, further comprising:

2           the operating system determining those disks of the plurality of spare disks which  
3 meet at least one selected rule to form a selected pool of disks;

4           the operating system sorting disks of the selected pool of disks in accordance with  
5 policies, and assigning a score to each disk as a result of the sorting;

6           the operating system selecting the disk with a highest score as the best spare disk.

1   33. (Previously Presented) The file server of claim 29, further comprising:

2           the operating system using a random selection process to select the best spare disk  
3 in the event that two or more disks appear to be equally the best spare disk.

1   34. (Previously Presented) A file server in a network storage system, comprising:



2           a storage adapter to connect to a plurality of disk storage units in the network  
3 storage system;  
4           an operating system to maintain a plurality of volumes, each volume associated  
5 with a set of disk storage units, the set of disk storage units selected from the plurality of  
6 disk storage units;  
7           the operating system maintaining a plurality of spare disks units selected from the  
8 plurality of disk storage units;  
9           the operating system choosing a best spare disk of the plurality of spare disks to  
10 replace a failed disk, the failed disk associated with any volume of the network storage  
11 system;  
12           the operating system attempting to determine a best spare disk by selecting those  
13 disks from the plurality of spare disks which meet at least one rule;  
14           the operating system replacing the failed disk with the best spare disk;  
15           in the event that no spare disk meets the at least one rule, the operating system se-  
16 lecting a spare disk which violates the at least one rule as a selected disk; and  
17           the operating system notifying an administrator that the selected spare disk vio-  
18 lates the rule.

1   35. (Previously Presented) A computer readable media, comprising:  
2           said computer readable media containing instructions for execution on a processor  
3 for the practice of a method for allocating a spare disk to replace a failed disk in a net-  
4 work storage system, the method having the steps of,  
5           maintaining a plurality of volumes in the network storage system, each volume  
6 associated with a set of disk storage units;  
7           maintaining a plurality of spare disks in the network storage system;  
8           choosing a best spare disk of the plurality of spare disks to replace a failed disk,  
9 the failed disk associated with any volume of the network storage system; and  
10           replacing the failed disk with the best spare disk.

1 36. (Cancelled)

1 37. (Previously Presented) The method of claim 13 wherein the best spare disk is chosen  
2 based upon physical proximity to the failed disk.

1 38. (Previously Presented) The method of claim 13 wherein the best spare disk is chosen  
2 based upon a comparison of the storage space of the spare disks and the failed disk.

1 39. (Currently Amended) ~~The method of claim 13~~ A method for allocating a spare disk  
2 to replace a failed disk in a network storage system, comprising:  
3 maintaining a plurality of volumes in the network storage system, each volume  
4 associated with a set of disk storage units;  
5 maintaining a plurality of spare disks in the network storage system;  
6 choosing a best spare disk of the plurality of spare disks to replace a failed disk,  
7 the failed disk associated with any volume of the network storage system, wherein the  
8 best spare disk is chosen based upon a comparison of the speed of the spare disks and the  
9 failed disk; and  
10 replacing the failed disk with the best spare disk.

1 40. (Previously Presented) A computer implemented method for allocating a spare stor-  
2 age device to replace a failed storage device in a network storage system, comprising:  
3 identifying a set of spare storage devices in the network storage system; and  
4 selecting a particular spare storage device of the set of spare storage devices to re-  
5 place the failed storage device, the particular spare storage device selected using a prox-  
6 imity policy in which preference is given to a spare storage device physically closest to  
7 the failed storage in the network storage system.

1 41. (Previously Presented) The method of claim 40 wherein the proximity policy gives  
2 preference to a spare storage device on a same shelf as the failed storage device.

1 42. (Previously Presented) The method of claim 40 wherein the proximity policy gives  
2 preference to a spare storage device on a same loop as the failed storage device.

1 43. (Previously Presented) The method of claim 40 wherein the proximity policy gives  
2 preference to a spare storage device on a same switch as the failed storage device.

1 44. (Cancelled)

1 45. (Previously Presented) A computer implemented method for allocating a spare stor-  
2 age device to replace a failed storage device in a network storage system, comprising:  
3 identifying a set of spare storage devices in the network storage system; and  
4 selecting a particular spare storage device of the set of spare storage devices to re-  
5 place the failed storage device, the particular spare storage device selected using a size  
6 policy in which preference is given to a spare storage device with minimum storage space  
7 in excess of the storage space of the failed disk.

1 46. (Previously Presented) A computer implemented method for allocating a spare stor-  
2 age device to replace a failed storage device in a network storage system, comprising:  
3 identifying a set of spare storage devices in the network storage system; and  
4 selecting a best spare storage device of the set of spare storage devices to replace  
5 the failed storage device, the best spare storage device selected using a speed policy in  
6 which preference is given to a spare storage device with a speed closest to that of the  
7 failed disk.

1 47. (Previously Presented) The method of claim 46 wherein the speed is a rotation  
2 speed.

1 48. (Previously Presented) The method of claim 46 wherein the speed is a data read  
2 speed.

1 49. (Previously Presented) The method of claim 46 wherein the speed is a data write  
2 speed.

1 50. (Previously Presented) A computer readable medium comprising executable pro-  
2 gram instructions for allocating a spare storage device to replace a failed storage device  
3 in a network storage system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and  
5 selecting a particular spare storage device of the set of spare storage devices to re-  
6 place the failed storage device, the particular spare storage device selected using a prox-  
7 imity policy in which preference is given to a spare storage device physically closest to  
8 the failed storage in the network storage system.

1 51. (Previously Presented) A computer readable medium comprising executable pro-  
2 gram instructions for allocating a spare storage device to replace a failed storage device  
3 in a network storage system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and  
5 selecting a particular spare storage device of the set of spare storage devices to re-  
6 place the failed storage device, the particular spare storage device selected using a size  
7 policy in which preference is given to a spare storage device with minimum storage space  
8 in excess of the storage space of the failed disk.

1 52. (Previously Presented) A computer readable medium comprising executable pro-  
2 gram instructions for allocating a spare storage device to replace a failed storage device  
3 in a network storage system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and  
5 selecting a best spare storage device of the set of spare storage devices to replace  
6 the failed storage device, the best spare storage device selected using a speed policy in  
7 which preference is given to a spare storage device with a speed closest to that of the  
8 failed disk.